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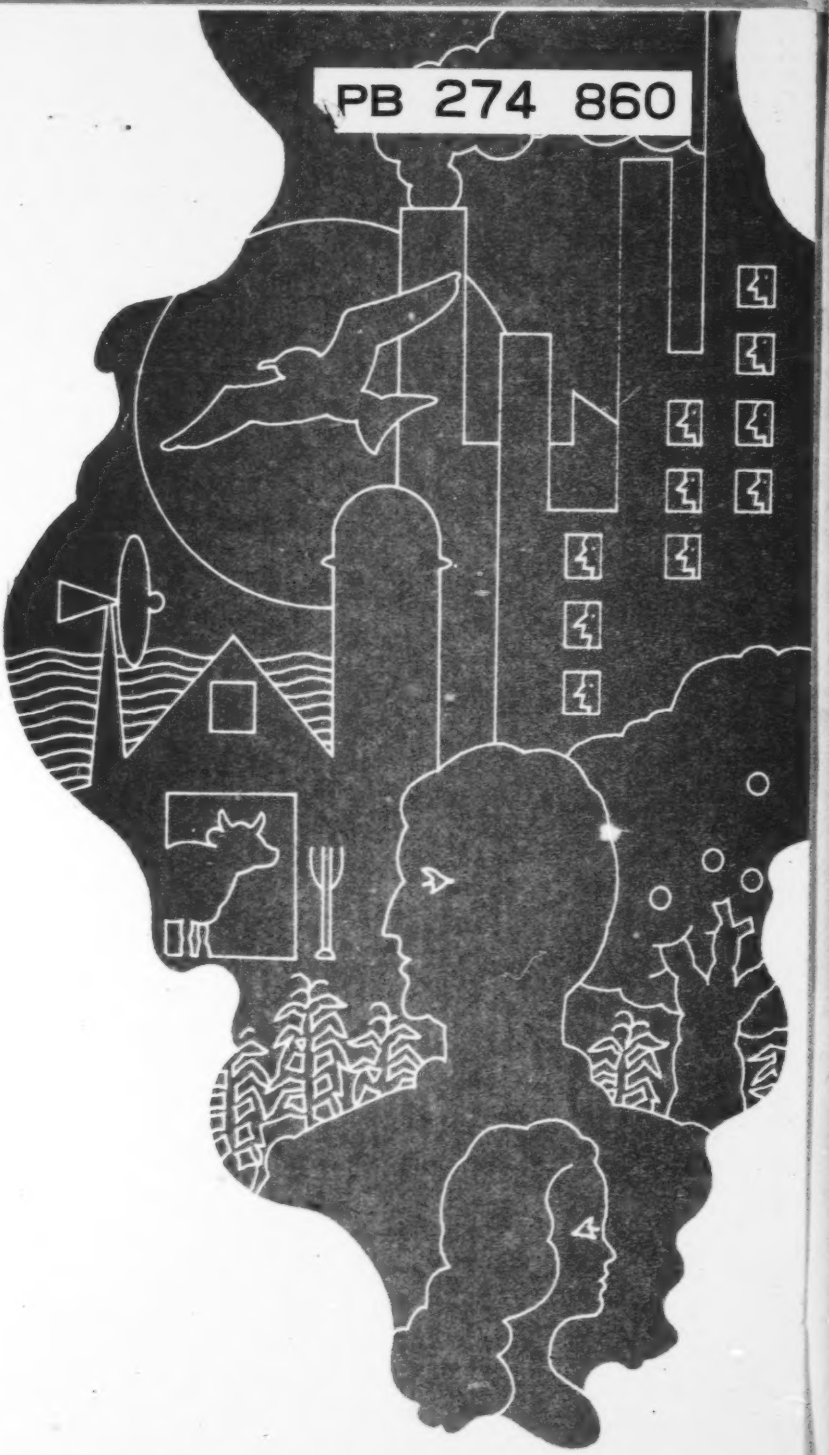

Survey of River Basin Planning Techniques

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SURVEY OF RIVER BASIN PLANNING TECHNIQUES

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October 1974

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INTRODUCTION

During the Year 1973-1974, the Illinois Institute of Technology conducted a study for the Illinois Institute for Environmental Quality to determine what administrative procedures and planning tools were being used by various state agencies to implement the areawide waste treatment management and river basin planning aspects of the 1972 Water Pollution Control Act Amendments (P.L. 92-500).

Within the 1972 Water Pollution Control Act Amendments, four sections were of direct importance to this study.

Sections 208 and 209 provide new authority to the U.S. Environmental Protection Agency (for areawide waste treatment management) and to the U.S. Water Resources Council (for Level B, Multi-State River Basin Planning), respectively. Section 303(e) requires states to develop a "continuing planning process" which must be certified by the U.S. EPA. Section 102(c) established Federal grants to the states to assist them in planning activities aimed at strengthening regional water quality management agencies.

The study attempted to collect data on the ongoing activities in these areas, so that Illinois and other states and agencies could review this data and use the best available techniques and approaches in implementing the river basin planning requirements of P.L. 92-500.

LEGISLATIVE INTERCONNECTIONS

The planning that individual states will perform on a subbasin level for water pollution abatement, if structured properly, could provide a substantial input to the required planning efforts of other state programs.

The project identified the interconnections between various programs so that the planning requirements of each could be structured into and lend support to the others. The following listing includes legislation which has direct interconnections or which may result in future legislation:

1. P.L. 92-500, 1972 Water Pollution Control Act Amendments.
2. Senate Bill S-268, National Land Use Policy.
3. State Land Use Policy.
4. P.L. 92-583, Coastal Zone Management Act.
5. National Growth Policy.
6. Corps of Engineers' Regional Wastewater Studies.
7. P.L. 92-419 Title 2, Amendments to the Watershed Protection and Flood Prevention Act, As Amended.
8. National Water Commission Report.
9. P.L. 89-80, Water Resources Planning Act.
10. P.L. 89-272 Title 2, the Solid Waste Disposal Act, As Amended.

LITERATURE SEARCH

Early in the study it became apparent that a large body of literature relating to the subject of the report existed. It also became evident that much of the most pertinent work was relatively current and came from a number of widely scattered sources. Consequently, it was determined that a customized literature search utilizing the "on-line" computer capabilities of the National Technical Information Service (NTIS) would be utilized. Further, because of its ability to identify the most recent and on-going research, the computerized files of the Smithsonian Science Information Exchange (SSIE) were also surveyed. A combined NTIS/SSIE research information package containing both completed research reports and ongoing research project information has been completed.

The NTIS search for the file of "River Basin Planning" yielded one hundred and nine (109) published items. The reports spanned the period of 1967-1973 with most publications being produced between 1970 and 1972.

The SSIE search of current and ongoing research projects identified two hundred and nine (209) efforts in the two areas mentioned above.

The study also included a manual review of various bibliographies and of other sources of information to supplement the automated NTIS/SSIE search.

REGIONAL REVIEW

Before beginning to view the activities of individual states and, in particular, their activities concerning water pollution and river basin planning, it was important to look at the regional and Federal agencies which provide an overview of state planning efforts and develop multi-state plans for major watersheds.

The mechanism used to assess capabilities and the regional intent was the "letter questionnaire". This questionnaire was specifically structured to:

1. Define background or technology studies,
2. Determine progress to date, and
3. Identify future action.

The questionnaire varies slightly as the responsible area of the specific agency changed,however, the thrust of the inquiry remained consistent. The following is taken from a typical letter questionnaire:

> "We are interested in finding out what steps your organization has taken or contemplaces taking in regard to the above sections of the Water Quality Act. Specifically:
>
> 1. Have you developed any bibliographies or conducted literature reviews in connection with watershed planning in general or the above legislation in particular?

2. Has your organization evaluated the available technology or formulated your approach for satisfying the river basin planning requirements?
3. Have the river basins been defined within your area?
4. Have you obtained or made arrangements to access any of the existing watershed models in the public domain; or have you contracted with any private consulting firms to use their expertise or models? If so, which models have you evaluated, and what were the prime reasons for your choice?
5. Have any river basin plans of any type (i.e., interim) been initiated or completed?
6. What is the scope of and/or the anticipated completion dates of these studies? Are copies available?
7. Have you or are you considering the use of the river basin plans or models in connection with the National Pollution Discharge Elimination System?
8. If you do not have a specific program established for implementing the above requirements, how do you envision your agency's response to this legislation?

"If there are any published reports, preliminary studies, or other sources of information relating to your response to the above questions, we would greatly appreciate receiving information and/or copies. If none exists, please formulate a response to the questions indicating your course of action to satisfy the new legislation."

The first series of people to receive questionnaires were the ten Regional Administrators of the U.S. Environmental Protection Agency.

Next, a questionnaire was sent to the Director of the U.S. Water Resources Council, Washington, D.C. The Water Resources Council has the responsibility to develop "Level B", Multi-State River Basin Planning".

And finally, questionnaires were mailed to the six existing River Basin Commissions:

1. Pacific Northwest Basin
2. Missouri Basin
3. Upper Mississippi Basin
4. Ohio River Basin
5. Great Lakes Basin
6. New England Basin

STATE BY STATE REVIEW

Utilizing the same basic letter questionnaire approach, an inquiry was sent to each of the state and territorial water

quality administrators as identified by the U.S. Environmental Protection Agency.

Table 1 summarizes the data received.

MODELING TECHNOLOGY

The use of the computer simulation model as a major planning tool has been growing. This has occurred for several reasons. These include:

1. The ability to analyze massive data in complex environments.
2. The ability to test alternate proposals and evaluate their effectiveness and efficiency.
3. The ability to predict performance of systems under various loading conditions.

Special mention should be made of three special cases of the use of modeling that we think are noteworthy:

1. In 1971, Water Resource Engineers, Inc., prepared a study for the United Nations Office of Technical Cooperation entitled, "Mathematical Models for Planning the Future Development and Management of the Vistula River System, Poland." This modeling approach evaluated a river basin and a series of proposed reservoirs and inner-basin transfers to achieve industrial growth and still maintain water

Table 1

● YES
○ NO
◑ UNDECIDED

	HAVE BIBLIOGRAPHIES OR LITERATURE REVIEWS BEEN CONDUCTED?	HAS AN APPROACH TO PLANNING BEEN FORMULATED?	HAVE RIVER BASINS BEEN DELINIATED?	HAVE COMPUTER MODELING PROGRAMS BEEN ACCESSED?	HAVE ANY BASIN PLANS BEEN INITIATED OR COMPLETED?	WILL BASIN PLANS OR MODELING BE USED IN CONNECTION WITH THE N.P.D.E.S. PROGRAM?	IS STATE LOCATED WITHIN AN EXISTING MULTI-STATE RIVER BASIN COMMISSION AREA?
ALABAMA	●	●	●	●	●	●	○
ALASKA	○	●	●	○	●	○	○
ARIZONA	○	●	●	●	●	○	○
ARKANSAS	●	○	●	●	●	●	○
CALIFORNIA	●	●	●	●	●	●	○
COLORADO	–	●	●	–	●	–	●
CONNECTICUT	○	●	●	●	●	●	●
DELAWARE	●	●	●	●	●	●	○
WASHINGTON D.C.	○	○	○	○	○	◑	○
FLORIDA	●	○	●	●	●	●	○
GEORGIA	●	●	●	●	●	●	○
HAWAII	●	●	●	○	●	◑	○
IDAHO	○	●	●	●	●	●	●
ILLINOIS	○	●	●	●	●	●	●
INDIANA	○	●	●	●	●	◑	●
IOWA	○	●	●	●	●	●	●
KANSAS	–	–	–	–	–	–	●
KENTUCKY	–	–	–	–	–	–	●
LOUISIANA	–	–	–	–	–	–	○
MAINE	○	●	●	●	●	●	●
MARYLAND	–	●	–	–	–	–	○

Table 1 (Cont'd)

● YES
○ NO
◑ UNDECIDED

	HAVE BIBLIOGRAPHIES OR LITERATURE REVIEWS BEEN CONDUCTED?	HAS AN APPROACH TO PLANNING BEEN FORMULATED?	HAVE RIVER BASINS BEEN DELINIATED?	HAVE COMPUTER MODELING PROGRAMS BEEN ACCESSED?	HAVE ANY BASIN PLANS BEEN INITIATED OR COMPLETED?	WILL BASIN PLANS OR MODELING BE USED IN CONNECTION WITH THE N.P.D.E.S. PROGRAM?	IS STATE LOCATED WITHIN AN EXISTING MULTI-STATE RIVER BASIN COMMISSION AREA?
MASSACHUSETTS	○	●	●	●	●	●	●
MICHIGAN	–	●	●	●	●	●	●
MINNESOTA	○	●	●	●	●	●	●
MISSISSIPPI	○	●	●	●	●	●	○
MISSOURI	–	–	–	–	–	–	●
MONTANA	○	●	●	○	●	○	●
NEBRASKA	●	●	●	●	●	●	●
NEVADA	●	●	●	●	●	●	●
NEW HAMPSHIRE	●	●	●	○	●	○	●
NEW JERSEY	–	–	–	–	–	–	○
NEW MEXICO	●	●	●	●	●	–	○
NEW YORK	–	●	●	●	●	●	●
NORTH CAROLINA	○	●	●	●	○	●	○
NORTH DAKOTA	○	●	●	○	●	◑	●
OHIO	●	●	●	●	●	●	●
OKLAHOMA	●	●	●	●	●	●	○
OREGON	–	–	–	–	–	–	●
PENNSYLVANIA	●	●	●	●	●	◑	●
RHODE ISLAND	○	●	●	●	●	●	○
SOUTH CAROLINA	○	●	●	●	●	●	○
SOUTH DAKOTA	–	●	●	●	○	◑	●

Table 1 (Cont'd)

● YES ○ NO ◑ UNDECIDED	HAVE BIBLIOGRAPHIES OR LITERATURE REVIEWS BEEN CONDUCTED?	HAS AN APPROACH TO PLANNING BEEN FORMULATED?	HAVE RIVER BASINS BEEN DELINIATED?	HAVE COMPUTER MODELING PROGRAMS BEEN ACCESSED?	HAVE ANY BASIN PLANS BEEN INITIATED OR COMPLETED?	WILL BASIN PLANS OR MODELING BE USED IN CONNECTION WITH THE N.P.D.E.S. PROGRAM?	IS STATE LOCATED WITHIN AN EXISTING MULTI-STATE RIVER BASIN COMMISSION AREA?
TENNESSEE	●	●	●	–	●	◑	●
TEXIS	●	●	●	●	●	●	○
UTAH	–	–	–	–	–	–	○
VERMONT	●	●	●	●	●	●	○
VIRGINIA	●	●	●	●	●	●	●
WASHINGTON	–	–	–	–	–	–	●
WEST VIRGINIA	–	–	–	–	–	–	●
WISCONSIN	●	●	●	●	●	●	●
WYOMING	○	●	●	○	●	●	●
GUAM	–	–	–	–	–	–	○
PUERTO RICO	●	●	●	●	●	●	○
VIRGIN ISLANDS	○	●	●	○	●	●	○
number responding	39	44	43	42	43	41	54
% ●	51	93	98	81	93	73	54
% ○	49	7	2	19	7	10	46
% ◑	0	0	0	0	0	17	0

quality standards. This study was unique in that it utilized the results of the water quality model to scale future industrial development.

2. In 1973, a model was developed at the Illinois Institute of Technology, entitled, "A Computer Simulation Model to Evaluate the Impact of Various Developmental Patterns on a Watershed." The study looked at the technique of using simulation models to determine the minimum environmental impact locations for urbanization within a watershed. The model also looked at the various waste treatment alternatives and standards, and evaluated the environmental changes resulting from urban placement and scale. The uniqueness of this study was twofold: 1) Its ability to use existing data; and 2) Its use as a predictive tool for urban placement.

3. In 1972, the Metropolitan Sanitary District of Greater Chicago utilized a computer simulation model of the Chicago River-Illinois River System to determine the effectiveness of waste treatment facilities to meet a 4 ppm and 5 ppm BOD, suspended solids standard, respectively. The computer simulation showed that with the use of treatment facilities producing a 10 ppm and 12 ppm BOD and suspended solids and the insertion of instream aeration facilities, the MSD would achieve the same water quality results with a

savings of approximately $100 million in capital cost and $10 million per year in annual cost. These results were entered into testimony along with simulation runs before the Illinois Pollution Control Board, and the results were accepted and water quality designations modified on the basis of these simulation runs.

SUMMARY

Table 1 graphically summarizes the information contained in this "Survey of River Basin Planning Techniques". It may be used to assess quickly the overall status of a particular state's planning program in regard to the major planning elements of the 1972 Water Pollution Control Act Amendments to Public Law 92-500.

The response to this survey was exceptionally good. Of all fifty states, three territorial water quality administrations and the District of Columbia, forty-three or 80% responded to the original questionnaire or follow-up correspondence. Of the ten regional offices of the U.S. Environmental Protection Agency, nine offices responded to the correspondence sent them. Additionally, the U.S. Water Resources Council and three of the six established River Basin Commissions (New England, Ohio, and Pacific Northwest) responsed to this survey. Many of the responses were responses in depth and provided

valuable data. Often, the responses referred to other sources of information such as work being conducted by various universities and consulting firms.

The recommendations which follow attempt to provide an overview of the survey findings.

It has become clear that the 1972 Water Pollution Control Act Amendments to P.L. 92-500 will not and cannot function in a vacuum. Emerging state and national policy in the areas of land use and growth have tremendous bearing on the planning of water pollution control programs and facilities. Water resources planning has entered the broadest areas of social, economic and environmental consideration. Therefore, it is recommended that all state programs responding to the 1972 Amendments to P.L. 92-500 respond in the broadest possible context to facilitate the maximum integration of water pollution control programs with other water and land use programs.

It has become clear that state programs are not the only scale at which water pollution control programs must function if benefits are to be optimized. Questions of interstate importance have surfaced which require a truly regional response if meaningful water quality improvements are to be achieved. It is recommended that state programs be structured so as to facilitate, to the maximum degree practical, the integration of programs which address water and land resources with their associated impact on future growth at an inter-

state river basin scale. State programs should, in other words, wherever practical, work as a compatible element of the Level B, Multi-State River Basin Planning process of the U.S. Water Resources Council. Similarly, the River Basin Commissions should structure their planning framework so as to facilitate this condition.

In order to facilitate these two recommendations, a third is suggested. Although areas and programs vary (both on an intra and interstate level) every attempt should be made to compile as broad a common data base as possible to work with. Naturally, automated machine handling of data becomes a minimum requirement. But data handling in itself is only reactive in nature. In order to take full advantage of the capabilities offered by today's advanced computer technology, it is recommended that maximum effort be applied to the development and use of predictive modeling techniques in the related areas of water and land use planning on a regional scale. This approach is particularly promising and will prove invaluable in: 1) The evaluation and comparison of various planning alternatives; and 2) The implementation of the planning activities of various programs described in Legislative Interconnections.

A further recommendation lies in the area of information services and data exchange activities. It is recommended that increased emphasis be placed on the national dissemination of information regarding water and land use planning programs developed at the state and regional levels.

And finally, it is recommended that the State of Illinois through the Illinois Environmental Protection Agency and the Institute for Environmental Quality establish a steering committee to define clearly the planning interconnections of various ongoing and proposed programs. Using the base information contained in this report, the steering committee would coordinate planning efforts, quite possibly through the use of a common data base and model system to meet the imposed legislative requirements, and also, develop functional and cost-effective programs.

DETAILED DATA

Copies of the full study which includes: 1) Individual state responses; and 2) The full literature search citations are available on loan from:

State of Illinois
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Library
309 W. Washington Street
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